UNESCO

Memory of the World
Programme

International Advisory Committee

Sub-Committee on Technology

Report of Meeting of Sub-Committee on Technology
held at Informatica El Cortes Inglés, Madrid, Spain
from January 17th to 19th 1999

Those Present:

Experts Appointed by UNESCO:

Dietrich Schüller (Chairman), Austrian Academy of Sciences, Vienna, Austria
Michael Alexander, British Library, Boston Spa, United Kingdom
Julián Bescós, Informática El Cortes Inglés, Madrid, Spain
George Boston (Rapporteur), Milton Keynes, United Kingdom
Adolf Knoll, National Library of the Czech Republic, Prague, Czech Republic
Jonas Palm, The Royal Library, Copenhagen, Denmark

Observers:

Juan Navarro, Informática El Cortes Inglés, Madrid, Spain
Dave de Roure, University of Southampton, United Kingdom
Marie-Thèrése Varlamoff, IFLA PAC Programme, Paris, France

UNESCO Officer:

Abdelaziz Abid, PGI, CII, Paris, France

See Annex A for contact details for the participants.

1. Adoption of the Agenda

The proposed Agenda was accepted with the addition of a report by Marie-Thèrése Varlamoff on the progress of the project to produce a CD-ROM on the preservation and digitisation of collections to be taken under Any Other Business.

2. Current Status of the Programme

The Programme Officer, Abdelaziz Abid, gave a report of the history and current status of the Programme (see Annex B).

Marie-Thèrése Varlamoff reported that a conference was to be held in March 1999 to discuss possible revision of the Hague Convention on the Safety of Cultural Heritage. The Hague Convention was intended to help preserve cultural materials in time of war, natural disaster etc. Concern had also been expressed in some quarters about the possibility of conflict between the National Committees for the Memory of the World Programme and the work of the longer established Blue Shield set up jointly by IFLA, ICA, ICOM and other cultural NGOs and the Red Cross/Red Crescent.

It was considered that initiatives such as the World Heritage Convention and the Memory of the World Programme were designed for times of calm while the Blue Shield and the Hague Convention came into operation in times of unrest or natural disaster. As such, the schemes complemented rather than conflicted with each other. As the World Heritage Convention and the Blue Shield came within the Cultural Heritage section of UNESCO, any potential conflict between the programmes could easily be resolved "in-house".

Dietrich Schüller said that there was not universal support for the Memory of the World Programme in the ICA and IFLA. The general public has accepted the need to preserve the physical structures covered by the World Heritage Convention. The need to provide similar protection for the documentary heritage has not been generally recognised yet. The public relations aspects of the Memory of the World Programme need to be strengthened.

Part of this publicity work was to improve the dissemination of knowledge of the problems facing collections of all types and the steps that can be taken to preserve the documents. This dissemination of existing technical information was part of the role of the Sub-Committee on Technology. The Sub-Committee was not the body to carry out original research. This rightly belonged to the specialist NGOs and their members. The various National Libraries and Archives are the generators of knowledge about preservation techniques: the Memory of the World Programme provides a channel for the dissemination of this knowledge.

Marie-Thèrése Varlamoff reported on the Survey of Digital Collections being undertaken by the IFLA Preservation and Conservation Programme with support from UNESCO. The questionnaire has been sent to National Libraries and some National Archives (see Annex C for a copy of the questionnaire). The questionnaire was designed to provide information about the current use of digitisation in collections. In addition, information was sought about the methods of digitisation used. The response to date has been poor and a follow-up letter is to be sent out. A report of the results is to be published later in 1999. One statement that can be made with certainty is that every responding institution has plans to digitise at least part of its collection.

Another topic covered by the questionnaire was the willingness of collections to allow their material to form part of a Virtual World Library. In practise, this is too large a project to be controlled by any one body. Copyright may also create some problems. It may be possible, however, to create a catalogue of on-line libraries and provide direct links from the catalogue to the sites. The initial emphasis will be to link National Libraries but other collections in university libraries, archives and museums will be included later.

One practical problem that has to be discussed and resolved is the digitisation of the same work by several institutions. This is obviously a waste of scarce resources. This will be an increasing problem as the use of digital techniques spread.

Michael Alexander reported on the European Union NEDLIB project to digitise a group of National Libraries. The project was being led by Det Kongelige Bibliothek in Copenhagen, Denmark and was due to end in 2001. One of the tasks of the project is to produce a common software platform for storing textual documents. To find more about the project, a link exists from the Kongelige Bibliothek Web Site.

3. External Evaluation of the Memory of the World Programme

Abdelaziz Abid presented the External Evaluation of the Memory of the World Programme and the response of UNESCO to the report. He said that the Assessors had recommended that UNESCO continue to encourage the formation of National Committees for the Memory of the World Programme. UNESCO was a little cautious about issuing frequent reminders to avoid the onset of "fatigue" in the recipients. The Director-General, Federico Mayor, was considering issuing a reminder from his office.

Another recommendation was to explore the addition of paragraphs about the Memory of the World Programme to the existing World Heritage Convention. This was possible but would take an estimated six years to achieve. Meanwhile the Programme would continue with the existing level of statutory support.

The Assessors also suggested that programmes with similar aims to the Memory of the World Programme should be included within the Programme. This idea was not universally supported in the library and archive world and was not being pursued at present. The provision of hypertext links between the World Wide Web site of the Programme and sites with similar content was being actively considered.

A recommendation that the Programme administrative support be strengthened had not been accepted by UNESCO. The Austrian Government had, however, offered to fund a temporary post for two years to help promote the publicity and marketing of the Programme.

4. Meeting of the Bureau of the International Advisory Committee, London, September 1998

George Boston, Rapporteur of the IAC, gave a report of the meeting. He said that one of the main tasks of the Bureau meeting was to review nominations received for inclusion of documents on the World Register of the Programme. A total of 58 nominations were considered by the Bureau. Eleven had been deferred from the Tashkent meeting to allow the nominators to provide additional information in support of the nominations. The remaining 47 were new nominations. He summarised the Bureau's recommendations to the IAC about the nominations.

The Bureau also took the opportunity to modify the membership and timetable of three Working Groups appointed at meeting of the IAC in Tashkent in 1997 to review the selection criteria for inclusion on the World Register and the operation of the administrative system for nominations. It was agreed that the three groups should work consecutively and not concurrently. The Convenor for each group should be a member of the Bureau and the three Conveners would also sit on each Working Group.

The topic for Group 1 is *To Refine and Develop the Criteria*. The group would consist of Edwina Peters (Convenor), Evgeny Kuzmin, Joachim-Felix Leonhard, Habibah Zon Yahaya and Moncef Fakhfakh.

The report of Working Group 1 would be passed to Working Group 2 with a copy sent to Abdelaziz Abid. The topic for Group 2 was *To Develop Guidelines for the Application of the Criteria to Specific Circumstances*. The group would consist of Habibah Zon Yahaya (Convenor), Ray Edmondson, Ingun Kvisteroy, Edwina Peters and Moncef Fakhfakh.

On completion, the report of Working Group 2 would be passed to Working Group 3 with a copy sent to Abdelaziz Abid. The topic for Group 3 was *To Develop Procedures for the Processing of Incoming Nominations*. The Convenor of Group 3 was Moncef Fakhfakh and the members Edwina Peters, Habibah Zon Yahaya and George Boston.

The Bureau also considered a discussion paper on *Selection Criteria, Guidelines and Process* submitted by Ray Edmondson. The Paper made a number of comments and suggestions regarding the future application of the Selection Criteria for nominations for inclusion on the World Register. In general, the Bureau supported these comments and recommended that they be further examined by the three Working Groups.

5. The Role of Digitisation

Dietrich Schüller reviewed the reasons for the creation of the Sub-Committee on Technology and its work to date. He emphasised that the Memory of the World Programme was not a programme for digitisation. In the early days of the Programme there was much pressure from commercial interests to make the central issue the production of CD-ROMs. This pressure had been strongly resisted. The Programme remained "platform-free". The primary aims were still the preservation of the world's documentary heritage and the improvement of access to it. Preservation is the pre-requisite of access: access the reason for preservation. The two factors are in a symbiotic relationship.

The Sub-Committee discussed the role of microfilm in preserving and providing access to textual material. The Sub-Committee was split about the continuing use of microfilm. One group argued that microfilm was a more stable medium than a digital carrier. The medium was well understood and the machinery required was simple. In emergencies, a simple magnifying glass was all that was needed to access a microfilm.

The other viewpoint accepted that microfilm offered good quality images of documents but felt that its use for access was limited compared to a digital copy. In addition, the stability of microfilm is the same as any other photographic medium ie. both the image and the carrier steadily decayed in storage. The rate was dependent upon the storage parameters. Factors such as the Vinegar Syndrome may affect the claims of Life Expectancies of 150 years for microfilm. In addition, the life of microfilm in tropical countries with poor storage conditions may be shorter than the life obtainable in temperate climates.

A digital carrier also decayed but, unlike the analogue image on a microfilm, the digital image could be restored to its original condition by means of error detection and correction algorithms built into the coding. More research and a major debate were needed to clarify thinking about the relative roles of microfilm and digitisation.

Adolf Knoll pointed out that both microfilmed and digital copies of texts separated the copy from the original carrier format ie. paper or parchment. The provision of access copies on permanent paper would allow readers access to the texts without having to interpose any machinery. He was also concerned about the use of mass storage systems holding many formats of information. The control and maintenance of the software required to decode a range of formats created new problems for custodians.

Abdelaziz Abid said that many documents have been copied to microfilm in Morocco. About half of the microfilms are unusable because the capture work was of poor quality. It may be that digitisation offers a more robust solution. George Boston replied that digital copies are not more robust than microfilm but it was far easier and cheaper to manage, verify and migrate a digital document.

Julián Bescós said that the Archivo General de Indias had employed ten people for four years to make digital copies of original documents on CD-ROM. The digital collection was now to migrate to hard discs and it would take four people one year to complete the task. It was clearly easier to copy a digital collection than to copy an analogue collection. Discussions were currently in progress as to whether all or part of the digitised collection should be made available on the Internet.

Adolf Knoll said that bridges needed to be built between the digital technologies and the more traditional formats. Microfilm can provide a long term preservation format but digital copies were better for access.

The Sub-Committee on Technology agreed that the reasons previously given by the Sub-Committee for the use of digital technology as part of the Programme were still valid. Digitisation was a valuable tool and its use should be considered by custodians of collections for access copies of documents and, in some cases, for preservation copies.

6. Practical Methods of Digitisation

The first publication of the Sub-Committee was the *Technical Aspects of Preservation: Recommendations of the Sub-Committee on Technology* in the *General Guidelines for the Safeguarding of the Documentary Heritage.* This publication was in need of revision because of the changes in technology and the wider acceptance of the role of digitisation as an access and preservation tool. The Recommendations need to be addressed from first principles rather than be just a re-write of the existing document. A request had been received from Catherine Pinion of IFLA asking for practical advice about the basic methods to be employed when digitising various categories of material. After some discussion, the Sub-Committee agreed to include this proposal in the new edition of the Recommendations.

The work will consist of an introductory chapter on the arguments for and against the use of digital techniques. There will be a chapter for each group of carriers giving basic methodological advice on how to digitise and the minimum technical parameters for both access copies and preservation copies of documents.

The section covering textual materials will be prepared by Michael Alexander, Julián Bescós and Adolf Knoll; Dietrich Schüller will prepare the section on audio materials; Jonas Palm will prepare the section on photographic materials; David de Roure will draft the section on optical carriers; and George Boston will draft the section on video with assistance from specialists in this area and edit the complete work.

It was agreed that initial drafts of the various sections will be prepared and sent to George Boston before February 28th 1999. A draft providing an outline of the work will be prepared in time for submission to the IAC at its next meeting scheduled for June 1999 in Vienna.

The Sub-Committee discussed a number of points concerning the parameters to be used for digitising documents. Dietrich Schüller said that there were two clear strands in the discussions. The audiovisual world has different requirements to the textual world. The textual world was looking to digitisation to improve access to documents without simultaneously increasing the stress on the originals caused by more users. The audiovisual world was seeking a preservation medium to preserve information that is endangered by the decay of carriers and/or the obsolescence of machinery.

a. Textual Materials

Cornell University have published guidelines for digitisation that recommend scanning textual documents at 600 dpi. Michael Alexander said that the cost of scanners able to scan at this level of resolution is, currently, high. It can only be justified for making facsimile copies of documents on acid-free paper as part of a book rescue programme. For the Memory of the World Programme, a range of scanning resolutions should be provided. The standard chosen should be dependent on the original material and the purpose of the copy. A higher standard should, perhaps, be used for manuscripts to reduce the number of occasions that access to the original document is required.

Julián Bescós showed some examples of digitised copies of manuscript pages from the Archivo General de Indias that clearly demonstrated that an increase in resolution did not necessarily mean an improvement in the quality of the image. The resolution chosen had to be appropriate to the original material. The Sub-Committee agreed that the Quality Index (QI) employed to determine the quality of microfilms should also be used to set the resolution standard when scanning printed texts.

The formula to calculate the Quality Index is:

QI = h x d x 0.0197
   where "h" is the height in millimetres of the smallest character
   and "d" is the number of dots per inch of the scanning system.

For catalogue or browse quality copies	QI >= 3.6
For access copies	QI >= 5.0
For preservation copies	QI >= 8.0

For determining the scanning resolution to be used for photographic images, the use of the ISO charts is recommended.

For documents with a mixture of text and images, it is recommended that the whole document be scanned at the standard required by the text and additional scans be made of any sections requiring a higher standard.

The use of compression and the problems that this can cause were discussed. It was noted that compressed image files can lose definition at sharp edges. It was pointed out that the use of compression on material digitised at a high standard was a waste of time and resources. It was better to use a lower digitisation resolution and, thus, avoid the need for compression.

David de Roure said that the practice at Southampton University was to scan and store digital images at a high standard for preservation copies but to use compressed images for access. Michael Alexander asked if it would be helpful to specify the level of compression under JPEG acceptable for different standards of images. He also informed the Sub-Committee of the introduction of a new graphic standard - Portable Network Graphic (PNG) - to replace GIF.

It was noted that the Photo-CD format was no longer considered acceptable for storing images.

b. Audiovisual Material

It was agreed that the primary standards quoted for audiovisual material should be preservation standards. Access standards should, where given, be clearly marked accordingly.

Since the original publication, the industry standard for audio has improved from 48 KHz sampling rate and 16 bit words to 48 KHz/20 bit. There was a distinct trend to move further towards 96 KHz/24 bit as the professional standard. The Sub-Committee agreed that the 48KHz/20 bit be the standard recommended for the digitisation of audio material for preservation purposes.

For video recordings, the Digital BetaCam format was becoming a *de-facto* standard. It was noted, however, that even at its minimum compression of 2:1, artefacts were apparent. It was agreed that further advice be sought before defining a standard.

c. Access Standards

The Sub-Committee discussed whether minimum access standards should be quoted. Some felt that it was not appropriate for the Sub-Committee to set standards for access copies. Concern was expressed that users with poor quality equipment may be denied access to Memory of the World material. Conversely, concern was also expressed that without a minimum access standard, material may be presented in an inappropriate manner. The Memory of the World Programme is a Programme of excellence.

It was agreed that for material within the Memory of the World Programme and using the Programme label, a minimum access standard should be set. It was recommended that the minimum standard for access copies of audio recordings made within the Memory of the World Programme should be 64MB - the equivalent of MPEG Layer 3. Minimum access standards for other materials will be quoted in the new edition of the *Technical Aspects of Preservation: Recommendations of the Sub-Committee on Technology*.

7. Harmonisation of Access

The Sub-Committee reaffirmed the concept that it should be possible to access all projects granted the use of the Memory of the World logo with a common navigation tool. The aim was to have a navigation tool suitable for use with any storage medium - CD-ROM, DVD,tape, hard disk etc.

Prior to the meeting, Adolf Knoll had circulated pre-publication copies of the latest version of the demonstration CD on the use of Hyper Text Marking Language (HTML) for access to digital documents within the Memory of the World Programme. At the meeting, copies of the production version of the CD were distributed.

Adolf Knoll gave a short summary of the work undertaken by the Czech National Library. The proposals used HTML as a platform. It was a very open platform with space for basic catalogue descriptions and other information. The format can be used within a multi-carrier system such as the Internet or a mass storage system as well as discrete carriers such as CD-ROMs.

George Boston reported that the Cataloguing and Documentation Committee of the International Association of Sound and Audiovisual Archives were investigating the need for additional HTML labels for audio materials.

It was noted that the only other known initiative to try to produce a common platform for access to digital documents was the Dublin Core. This was, however, primarily concerned with navigation on the Internet.

The Sub-Committee discussed the CD-ROM. They endorsed the work undertaken by the Czech National Library and thanked Adolf Knoll for leading the project team. The IAC is to be advised to formally accept the use of HTML as proposed by the Czech National Library for all future projects within the Memory of the World Programme.

Adolf Knoll reported that work was being undertaken to develop a new language to operate under SQL in parallel with HTML. This new software - XML - was not expected to cause problems for the continuing use of HTML but the situation would be kept under review.

8. Any Other Business

a. Safeguarding the Documentary Heritage:
A Guide to Standards, Recommended Practices and Reference Literature Related to the Preservation of Documents of All Kinds

Dietrich Schüller gave notice to the Sub-Committee that this publication would be due for revision at the end of 1999. The various authors would be contacted and asked to consider possible changes to the texts. The bibliographies etc. also need to be updated. The addition of images, perhaps in colour, is to be considered.

Abdelaziz Abid reported that the publication is proving to be very popular. Every day, several requests for copies were received by UNESCO. The work is currently available in English and French. The Sub-Committee agreed that it needed to be made available in the other official UNESCO languages.

Julián Bescós agreed to arrange the translation of the publication into Spanish. George Boston will send him a copy of the manuscript on diskette. Abdelaziz Abid will arrange a translation into Arabic, the ICA will be asked to provide a Chinese translation and Marie-Thèrése Varlamoff will arrange a translation into Russian. Translations into other languages would be welcomed. It was noted that the impending second edition is not expected to have radical changes in the texts so translation work can safely be undertaken on the existing text.

b. Preservation CD-ROM

Marie-ThPrJse Varlamoff reported on the progress to date on the production of this CD-ROM. The project was the concept of Astrid Brandt and a contract had been agreed between IFLA and the French Ministry of Culture.

The CD would be in English and French and cover topics such as environmental control, handling of documents etc. The disk would contain about 500 images in addition to the texts. The navigation through the disk will use the HTML marker format devised by the Czech National Library. It is anticipated that approval copies will be available in August and the final printing of 2000 copies will be ready by the end of November 1999. The disks will be free of charge to avoid difficulties with copyright.

c. Research into the Stability of Recordable CDs.

George Boston reported on the current state of research being undertaken by Jean-Marc Fontaine on behalf of the Bibliothèque National de France (see ANNEX D for a report from Jean-Marc Fontaine). The work was showing a wide variation in the Life Expectancies (LE) of different types and makes of disks. It was emphasised that these were interim results and that the work was still continuing. The work concentrated on the effects of ageing and decay on the signal rather than the actual chemistry of the decay. The questions that required answering include "How does a CD-R actually work?"; "What is the chemical/physical action at work in the dye layer?".

The first major difficulty in researching CD-Rs was to identify the different types of dye layer in use. Professor Jacque Lemaire of the Laboratoire de Photo Chimie at the Université de Clermont-Ferrand was assisting by analysing the dye layers and the binder materials used. It appears that a "quencher" is added to some dye mixes to stabilise the dye under the influence of lasers. The percentage of quencher used has a major effect upon the Life Expectancy of the disc. The quenchers are certainly added to cyanine dyes but their use has not been confirmed in phtalocyanine dyes.

Other results from the tests showed that factors affecting the quality of recordings - the fewest occurrences of BLER errors - included the use of:

> An Apple Mac computer
> A SCSI data link
> An external recorder
> A "Gold" - phtalocyanine - disc
> A four times real time recording speed

Jonas Palm said that problems with the replay of CD-Rs had been reported by a number of people. The causes of the problems seem to be similar to those that can occur with colour photographs. He felt that the use of CD-Rs could not be recommended for long term storage. George Boston replied that for decaying audio recordings, transfer to a new carrier was the only solution to preserve the sounds. CD-R was recommended on the basis that it was the "least worst" choice not because it was ideal.

Julián Bescós said that the Archivo General de Indias was using CD-R to make about ten copies of digital master discs each day. The copies were not verified against the master but few problems had been experienced. The major problem has been with scratches on the label side of the CD-Rs causing data reading difficulties.

9. Closing Session

Dietrich Schüller, on behalf of the Sub-Committee on Technology, thanked Julián Bescós and Informática El Cortes Inglés for helping to make the meeting such a success. The facilities and hospitality had enabled the participants to achieve the aims of the meeting efficiently and in comfort.

Annex A

List of Participants

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Annex D

Interim Results of Research into Recordable CDs

By Jean-Marc Fontaine

1. Chemical Characterisation of CD-R Recording Layer

Recording layer analyses have been carried out on phtalocyanine pigments (CNEP) but the exact formulation of the dye layer is not easy to work out because the composition of neither the dye or the binder is known. An estimation of the percentage of dye compound in the recording layer is that it is more than 10%. Testing the binder indicates that it is an acrylic copolymer but this needs to be confirmed and quantities confirmed for different recording layers.

2. Thermal Aging

Signal measurements applied to discs after exposure to temperatures of 80EC revealed important changes even after periods as short as a few tens of hours. Chemical analyses showed that the back layer of varnish showed no modifications so further studies were concentrated on the dye layer.

Thermal exposure led to physical deformation that gave rise to signal loss. The degradation has to be attributed primarily to these physical changes rather than to changes in the chemistry of the layer. If changes are observed in CD-Rs over a period, thermo-oxidation arises in peripheral zones. Note that leaving a CD-R in an active player for extended periods can also lead to damage.

3. Photo Aging

CD-Rs are very sensitive to sunlight or artificial equivalents. The strength effect varies depending on the type of dye layer - the cyanin family of dyes are very sensitive and the phtalocyanin are less sensitive.

The degradation process has not been defined yet. The experimental procedures have to be refined to ensure that the effects on the CD-R of a high power light source (Xenotest) are restricted to the light output and not to any heat generated. To date, no explanation has been hypothesised for the decolourisation of cyanine discs exposed to strong light.

4. Influence of the Laser Power

Three identical discs were taken and two were recorded with a constant laser power using a Mitsui recorder at double speed:

   Disc 1 - kept blank as a control
   Disc 2 - recorded with minimum laser power (6 mW)
   Disc 3 - recorded with maximum laser power (9 mW)

i. Chemical Analyses

The integrity of the complete system is not preserved: an unstable site appears. This could be at the start of a significant change in the nominal activation energy levels.

ii. Player Signal Analyses

From the methodological point of view, such tests raise questions about the supremacy of the error rate (BLER) over other parameters to characterise the evolution of quality of CD-Rs. In particular whether the examination of SYMMETRY, which is particularly sensitive to light, should also be considered.

Such experiments provide additional information about the recording process. In particular, information about the numerous interactions between parameters. Nether the less, the results cannot be applied in practice because the laser power is controlled automatically - only in a laboratory is it possible to control the power of the lasers.

5. Recording Configuration

This covers the interaction of the disc and the machine. It appears that stand-alone machines do not give the best recordings. The use of a good SCSI/software chain is certainly preferable. Other factors include using a recorder with a good performance specification is essential; having a large buffer memory (if this is too small, interruptions in the data flow can occur giving rise to E32 errors); and optical performance and quality.

Some experiments conducted with several recorders linked to the same SCSI system show a relatively high range of performance results.

6. Effects of Make of Disc and Recording Speed

Measurements were carried out on eight different labels of discs. Test recordings were made using the correct laser power and at a range of recording speeds. Differences were detected between discs from different manufacturers.

In addition, there was a clear improvement in quality as the speed of the disc increased from x1 through x2 to x4 normal speed. At present, there is no explanation for this improvement with increase in recording speed. It is possible that it is an effect of the heat dissipation pattern in the polycarbonate layer.

7. Disc Duration/Recording Density

This is one of the most important quality factors. CD-Rs are available in two durations - 63 minute discs with a capacity of 550 MB and 74 minute with a capacity of 650 MB. The shorter, lower data density discs always performed better in the tests ie. gave a recording with fewer BLER errors. However, commercial pressures in favour of the 74 minute discs have made the shorter discs more difficult to obtain.

8. ANSI/PIMA Life Expectancy Test Method

The ANSI/PIMA working group is working on a document dealing with Life Expectancy testing of CD-Rs. This is document is entitled *Life Expectancy of Information Stored in Recordable Compact Disc Systems - Method for Estimating Based on Effects of Temperature and Relative Humidity* and was circulated for discussion on December 14th 1998.